Gas flow measuring device

Stationary and portable gas flow and pressure measuring devices are required for the calibration, production and standardization of devices of all types. Devices available to date have the disadvantage that the gas flow measurements are influenced by the environmental conditions, and miscalibrations therefore occur. This is very problematic especially in the case of medical devices, such as respiratory and anesthesia devices. Since the devices are used worldwide, miscalibrations also result from incorrect operation of the devices.

There have to date been several efforts to perform an exact gas measurement. The following measuring principles are known:

Ultrasound

2 combined ultrasonic transmitter/receiver units which are arranged at an angle to the inflow direction. These send an ultrasound pulse at regular intervals and wait for the reception of the pulse of the other transmitter. If ultrasound waves cover a defined distance s in a known medium they require for this purpose a time t dependent on their propagation velocity. The propagation velocity of a wave is thus dependent on the transit time of the signal from one transmitter/receiver to the other.

Volume counter with measuring vanes

A vane wheel is caused to rotate so that its speed is proportional to the mean flow rate.

Wind pressure method

The medium flows through a nozzle or aperture. The cross-section is narrowed, which accelerates the flow rate. In order to avoid vortex formation, venturi nozzles are generally used. The mass flow is then calculated from the pressure difference across the nozzle.

Laminar flow elements

Like the wind pressure method, laminar flow elements are based on the fact that the flow can be calculated from a pressure difference. In contrast thereto, however, the flow is linear relative to the measured pressure difference. In medicine, the laminar flow elements are known as pneumotachographs

Hot-wire anenometer

A wire or a surface is heated to a temperature which is above the ambient temperature. Molecules which strike this surface and then fly off again absorb kinetic energy there. The heat loss of the heated surface is proportional to the temperature difference between the heated surface and the environment and to the number of molecules striking per unit time.

All these known structures are at their limits, and the exactness of the measurement is restricted. Particularly in the area of medicine, however, it was intended to increase the accuracy further. This is the object of the invention. It is intended to improve the accuracy of gas flow measurement.

The measurement properties of the individual methods differ and, depending on the application, one or other measuring device – optionally optimized – is used.

Particularly in the case of special devices in the area of medicine, such as, for example, respiratory devices, anesthesia devices, etc., however, a very wide range of applications are present in a device, so that it was necessary to date to measure using a plurality of measuring devices, or to be satisfied with a certain accuracy of measurement – for example for standardization or monitoring purposes.

The invention therefore relates to a device for exact flow measurement of gases independently of the environmental conditions, such as temperature,

humidity, type of gas, oxygen concentration and ambient pressure. It is intended to make as few compromises as possible and to be able to measure a large number of very different applications with high accuracy. Furthermore, the operation should be as easy as possible in order to avoid incorrect manipulations. The measurement can be capable of being carried out under any environmental conditions as far as possible with the same accuracy.

These objects are achieved by the Applicant's portable measuring device "*FlowAnalyser*".

The measuring device according to the invention comprises a device (1) for the measurement of gases with a gas channel (3), with a sieve (4) and with a plurality of different sensors (5), (6), (7), (8), (9), (10), a plurality of sensors (5-10) which can exactly measure both humid and dry gases being installed in the gas channel (3) through which the gas stream to be measured flows, and all sensors being connected to a computer which compares the individual measured values of the individual sensors with one another and comprises a program by means of which a consolidated measured value for the gas actually flowing through can be specified from various measured values. Certain sensors serve for determining the environmental conditions.

In the device according to the invention, in particular the environmental influences of humidity, absolute pressure, temperature and oxygen concentration are taken into account in the calculation of the gas flow in the computer, for example a microcontroller (11), so that the measurement is always exactly correct under all environmental conditions.

According to a particular embodiment of the invention, the gas channel (3) is in the form of a compact block in which all sensors are directly integrated. The use of tubes between the sensors is avoided according to the invention.

According to a particular embodiment of the invention, the gas channel (3) and the sieve (4) are designed so that, independently of the direction of flow, a laminar gas flow results, and that bidirectional gas measurement is thus possible as a special feature. This is advantageous, for example, in respiratory devices since it is possible thereby to measure both the gas mixture delivered to the patient and the gas mixture delivered back by the patient, which permits conclusions about the patient's condition.

According to a further development of the invention, a Direct Access Knob (DAK) for direct access to help and measured values is arranged on the front panel of the device, adjacent to the gas channel (3), which direct access knob is connected by the computer to a display and permits immediate display of current measured values or help functions on this display.

The invention is not limited to certain sensors or sensor types. Rather, the person skilled in the art can choose from the known sensor types, for example according to the introduction to the description.

Description of figures

Figure 1 shows the device for gas flow measurement. The gas flow 2 flows through the gas channel 3 and through the sieve 4 which is mounted in the middle of the gas channel 3. This sieve can be easily changed and, like the other components, is shown only schematically. The gas channel 3 is formed so as to result in a laminar flow of the gas flowing through. A large number of sensors 5-10 having different measuring tasks and/or different measuring ranges is present in the gas channel. A microcontroller 11, which is not shown in detail, processes the different measured values in order to be able to determine a measured flow value which is as exact as possible for the respective application under the respective environmental conditions.

The sensor values of the sensors 5-10 are thus read in by the microcontroller 11 preferably provided as a module and are converted into an exact gas flow.

Fig. 4 shows a preferred overall design of the device according to the invention.

List of reference numerals (part of the disclosure together with the drawing):

1	Gas flow measuring device
2	Gas flow
3	Gas channel
4	Sieve
5	Differential pressure sensor
6	Absolute pressure sensor
7	Relative pressure sensor
8	Oxygen sensor
9	Humidity sensor
10	Temperature sensor
11	Microcontroller system
12	Direct Access Knob (DAK)